E A B VIDEOLAB

INSTRUCTION MANUAL

INTRODUCTION

The Videolab E-module is a general purpose voltage controlled video synthesizer capable of producing the full range of video special effects available from the best broadcast switchers. The purpose of this manual is to provide a brief description of the theory and operation of the Videolab.

The Videolab E-module is intended to be as nearly as possible a stand-alone video processor which accepts up to four (six in some cases) images from video cameras and tape and produces an output image which can contain any or all of these original images in altered or unaltered form. Various operations such as switching, fading, keying, wipes, titles, and colorization may be performed on the images to produce the desired output image.

Topics of discussion in this brief manual will include General Theory, Description of Submodules, External Connection of the System, and Application Examples. EAB provides instruction courses in the use of the Videolab. Please contact us for details.

VIDEOLAB GENERAL THEORY

The Videolab E-module consists of ten sections, or submodules. These units are interconnected to produce effects. A large degree of voltage control is used, making the Videolab E-module similar in operation to, and compatible with, most types of electronic music synthesizers. All Videolab modules utilize standard signal levels and connectors and all modules are compatible.

There are two types of signals in the Videolab. These are video signals, which correspond to images, and control signals, which may be used to switch, mix, or otherwise modify these images. A technical description of these signals is found in the E-module Technical Manual. All Videolab submodules may accept or produce either or both of these signal types.

The effects produced in the Videolab are accomplished by interconnecting these submodules with standard unshielded, stacking type patch cords, provided with the E-module. All jacks are color-coded to indicate their function and there are a few simple interconnection rules. A list of some interconnection rules is shown below.

Interconnection Rules:

1. It is impossible to damage the E-module by incorrect connection of patchcords within the system. As long as no jack on the front panel is connected to a source outside the Videolab, all connections are permitted. Most random connections, of course, will not produce a usable image.

2. If the interconnection rules are followed it is difficult, if not impossible, to produce a video signal at the output of the E-module which cannot be recorded or passed through a standard video channel.

3. Inputs and outputs are color coded as follows:

Red jack--	Video signal source
Blue jack--	Video signal input
Yellow jack--	Control signal source
Green jack--	Control signal input

Video sources are connected to video inputs (red to blue) and control sources are connected to control inputs (yellow to green). There are exceptions to this rule which are noted in the Applications Section of this minual.

4. Any output can drive at least 4 inputs.

5. The shortest patchcord possible should be used for connecting between submodules.

6. No connections should be made to the front panel jacks except through an EAB authorized interface.

VIDEOLAB EXTERNAL CONNECTIONS

The Videolab E-module has a built in Color Genlock and may be used without an external sync generator. To use the E-module in this mode, a composite color signal source is connected to channel 1, and up to 3 other monochrome or color sources are connected to the E-module through an EAB adapter to the 50-pin connector at the rear of the E-module. The videolab locks to the master source on input 1. It both sends timing signals to the slave sources or channels 2 through 4 and recieves the video of these sources through the multipin adapter. This arrangement is exceedingly simple and even allows locking to a 3/4" video tape source. It should be noted, however, that many color cameras, (the Sony 1610 included) will not lock to this 'heterodyne' tape signal and cannot be used as slave sources in this mode. All monochrome cameras which accept external sync can easily be used in this mode. EAB offers several standard and custom multipin adapters for use with the E-module.

If the Videolab E-module is used in a studio environment, no multipin adapter is required and the user will simply connect four properly synchronized and timed video sources to the four BNC inputs on the rear panel. In this case, if the input on channel 1 is a fully composite color signal, the E-module can either be used in the Genlock mode or the External Sync mode. If the Genlock mode is used, no other sync connections are required. If external sync is used the indicated drive inputs at the rear of the E-module should be supplied with the appropriate Sync Drive and Subcarrier Drive signals. In this case, all inputs may be either composite or non-composite. All inputs have switched 75 ohm terminations.

The Videolab E-module outputs are fully composite 1-v, 75 ohm sources. There are three outputs, labeled Preview A, Preview B, and Main Output. In a typical application making full use of the E-module's capabilities, three color monitors are used which are viewed by the Videolab operator. The left monitor will be connected to Preview A, the right monitor will be connected to Preview B, and the center monitor will be connected to the Main Output, which is the source of the video signal to be recorded or broadcast. This should be a 'loop through' connection, with the cable terminated at its destination.

Note that external connections to the Videolab are very simple, with external drive signals not being required so long as the channel 1 input signal is fully composite and contains both sync and color burst components. External connections are to be made only at the rear of the E-module.

The rear panel of the E-module has, in addition to the four termination switches provided, two 'select' switches and two controls. In the simplest mode of operation, the two switches should be in the 'up', or 'Genlock' position. The E-module is then automatically locked to the composite video signal applied to video input '1'. The E-module can be externally locked if the 'select' switch is in the 'down' position. Of the two controls, the upper, or 'Genlock Level', control should be fully clockwise for most video signals (this control may be omitted on some Videolabs). The lower, or color phase lock control should be set near center range but may be adjusted to correct small color errors in the input video. This control should be set with a 'color bar' signal applied to video input 1.

MATRIX SWITCHER

The Matrix Switcher accepts up to four video input signals and provides up to four video outputs which are controlled by sixteen control signal inputs. The Matrix Switcher is also where the four external video sources, video 1, 2, 3, and 4, appear at the front panel for processing. Most conventional special effects, such as switches, fades, dissolves, and luminance keys, make use of the Matrix Switcher.

The top row of red jacks are the video sources video 1, 2, 3, and 4. These signals can be patched to any blue jack on the panel. The principal function of the Videolab is to allow the video person to operate upon these four video sources (images), singly and in combination, and to produce high quality video signals which exit the system through the Output Keyer Fader. If this top row of red jacks is patched to the blue Matrix Switcher inputs below, these images are available for processing by the Matrix Switcher.

The Matrix Switcher is a device with four signal inputs and four signal outputs and sixteen control inputs. To produce an output, a control signal is applied at on of the "crosspoints". A full scale (maximum) control signal, when applied to any green jack, will cause the video signal entering the blue jack above it to appear full amplitude at the red video output to the right.

The Switcher action is instantaneous and linearly proportional to the control input. Thus the video signal output at each row of the Matrix Switcher may be described as the additive sum of each column multiplied by its normalized crospoint control signal. Mathematically:

Let V_i be the video input for the i^{th} column.

V_j be the video output for the j^{th} row.

C_{ij} be the normalized control signal input appearing at the crosspoint of the i^{th} column and the j^{th} row where

$$C = \frac{\text{Control Signal In}}{\text{Full Scale Control Signal}}$$

Then the video output of each row is defined as:

$$V_j = \sum_{i=1}^{i=4} C_{ij}V_i \; ; \quad \text{or,}$$

$$V_j = C_{1j}V_1 + C_{2j}V_2 + C_{3j}V_3 + C_{4j}V_4$$

The Matrix Switcher introduces no color shift into video signals passing through. It is used in the Videolab for Fades, Wipes, Keys, Cuts, and is utilized in nearly all Videolab effects. The applications section of this manual will describe these effects fully.

OUTPUT KEYER/FADER

As the matrix switcher is the point of entry for all Videolab signals in the E-module, the Output Keyer/Fader is the point of exit. The OKF accepts four video and four control signals. The outputs of the OKF are located on the back panel, appear on three BNC connectors, and deliver a standard NTSC, fully composite video signal for use in professional studio quality equipment.

The Output Keyer/Fader has basically two inputs and three outputs. The dual video and control jacks at either side of the Linear Fader in the OKF are mixing inputs and can each be considered a single input.

The structure of the Output Keyer/Fader is as follows: the video signals appearing at the A and B inputs at the right and left of the unit enter the OKF and are passed unchanged (except for amplification, conditioning, and the addition of timing signals) to the two "preview" outputs at the rear of the E-module. The third or "Main" output is formed by fading between the "A" and "B" signals.

The structure allows the Videolab user to observe both "A" and "B" video signals on monitors and to fade between these two independent signals to produce the desired image.

This "fade" can be done electronically by means of the voltage control inputs, as described in the Colorizer. Because of the instantaneous response of control inputs this may be an automatic fade, key, or simple or complex wipe.

The Output Keyer/Fader is the last level of control of the E-module.

LINEAR KEY COLORIZER

The colorizer has two video signal inputs, a single control signal input, and a single video signal output. The colorizer produces internally a synthetic color video signal based on the gray scale of the input video signal and provides for mixing this signal with the input signal to produce the output.

A description of the colorizer can be divided into two parts. First, the production of the synthetic color video signal and second, the means by which the synthetic color video signal is mixed with the input signal to form the output.

To form the synthetic color video signal, the colorizer first strips any color information from the input video and then "slices" the gray scale of this signal into four parts. The synthetic color video signal is then produced by assigning arbitary colors and gray levels to each of these "slices". The location of the slice points is determined by the position of the slider potentiometers. The lowest (darkest) transition point is determined by the leftmost slider and the highest (lighest) transition point is determined by the rightmost slider. The color and brightness of each section of the four-level synthetic video signal is set by each of the four columns of three controls. The upper two of these controls set chroma (color) and the lower control sets luminance (brightness). When the two upper knobs are centered (set to "5"), no color is produced.

The most interesting effects using the colorizer are made by mixing the colorized signal with the original. The colorizer has a "Mix" control which provides for this. When the "EXT" switch is in the "down" position, the "Mix" control will mix the colorizer output with the video signal appearing at the "In" jack. When the "Ext" switch is in the "up" position, the mix control will mix the colorizer output with the video signal applied to the "EXT" jack. The resultant mixed signal appears at the "Out" jack. A fully

clockwise setting of the "Mix" control produces an output which is 100% synthetic signal and a fully counterclockwise setting produces an unmodified video signal.

The mix, or crossfade, described above may be also performed electronically by means of applying a control signal to the green jack directly below the "Mix" control. A control signal applied here, as anywhere else in any Videolab module, has instantaneous effect. Because of this, a variety of effects may be performed by applying a control signal to this input. These effects depend on how the control signal is derived, and include, in the case of the colorizer, switching, keying, color titles, and other effects.

A principal feature of the colorizer which is found very rarely in other multi-level colorizers is the soft-edge feature. The "Edge" control, when rotated counterclockwise, allows linear, or "soft-edge" keying. This important feature minimizes the quantization noise often found in so-called "digital" colorizers with no loss of resolution or time delay. Advancing the control clockwise gives full hard-edge (digital) keying between gray scale segments when desired.

It is important to note that the linear edge feature is is available in all Videolab modules.

CV AND KEY SOURCES

The Keyers are a source of complementary control signals. Outputs may be changed manually, by turning the "ref" control, or may be generated from the luminance component of video material. The Keyers are used for keys, wipes, split-screens, and other effects.

The most useful application of the Keyer is to generate a "slicing" signal, based on either real video material or the synthetic video waveforms available from the Pattern Generator. In both cases, a video signal is applied to the blue Keyer input and results in two instantaneously changing complementary control signal outputs which can be fed to the Matrix Switcher or Output Keyer / Fader to switch other video signals. If the Key Source input is a real video image, the Key Source outputs can be applied to the Matrix Switcher to form a luminance key. If, on the other hand, the input to the Keyer is a synthetic video waveform from the Pattern Generator, a wipe, insert, or split-screen will be produced from the same patch. In each case, the key hardness is variable by the "Gain" control.

Electronically, the CV/Key Source can be described as simply a very fast, variable gain, DC differential amplifier with complementary differential outputs which are clipped at zero and full scale. The amplifier rejects the chrominance, or color information, and operates on the gray scale, or luminance component, of the video signal to produce two control signal outputs balanced about the center of the control range.

ATTENUATORS AND CV SOURCES

These units serve as both manually adjustable control voltage sources and adjustable video or control signal attenuators.

When the switch is in the lower position, the module will supply at its yellow output jack a control signal whose amplitude will vary from zero to full scale when the control knob is turned clockwise. When the switch is in the "up" position the unit acts as a variable attenuator of the control signal or video signal applied to the green input jack.

The Attenuator/CV Source is used whenever a manually adjustable control signal is required or when it is necessary to manually fade a control or video signal. Several examples are included in the applications section.

PATTERN GENERATOR

The pattern generator is a source of synthetic video signals. These signals may be used as sources to key upon to produce simple or complex wipes. The pattern generator outputs (particularly the " " output) may also be fed to the colorizer to generate patterns for use as backgrounds.

Electronically, the pattern generator consists of two oscillators with selectable sine/triangle outputs and square wive outputs. The frenquency of each oscillator is controllable either by its control knob or by an external control voltage.

The Horizontal Oscillator is permanently frequency-locked and and the Vertical Oscillator may be unlocked by means of a switch, allowing the patterns to move vertically.

A sum, or "Σ" output provides a video signal which, when colorized or keyed upon, can be used for square, circular, or diamond shaped patterns, singly or in multiples for keys, wipes, or backgrounds. This output is the average of the sine/triangle output of each oscillator.

PROCESSOR

The processor unit is an analog device which performs the linear functions of addition, subtraction, and averaging, and the nonlinear functions of gating and blanking. The processor accepts eight control or video signal inputs and has three outputs.

The lowest output jack on the processor has an output signal which is the average of the two signals appearing at the jacks at either side. The outputs at either side are the gated algebraic sum of the inputs above.

The add-subtract function of the six upper jacks is easily understood. The gate input functions to pass only signals which are lower in amplitude than that signal appearing at the gate input. However if no patch cord is connected to the gate input, the module acts as if a full scale signal were applied, allowing the unit to function as a simple adder-subtractor (the two gate inputs are the only inputs in the E-module which function this way. All other inputs in the E-module treat an unconnected input as a zero input level).

This unusual action is helpful in performing certain types of keys and pattern generation. An additional feature of the processor is that video blanking is inserted at the main output, allowing the processor to accept certain types of unsynchronized non-video signals from outside sources and to produce a signal usable for complex pattern generation.

Although the processor uses yellow and green jacks, implying operation with central signal only, it will also accept and process video signals.

The processor is useful in synthesizing patterns for colorizing. It also will invert video and provides an easy means for keying titles.

DUAL TRI-STABLE

The Tri-stables are sources of control signals which, when triggered, will produce these signals at a slowly or rapidly changing rate. The Tri-stables are useful for wipes and fades.

Each Tri-stable has three control signal outputs which are the three yellow jacks. In the stable condition, one of these outputs is at full scale and the other two are at zero. Each output has an associated push-button and indicator. The indicator is fully lit when the output is "on", or at full output. Pressing the push-button next to an "off" output causes that output to turn "on" and causes the output which was previously "on" to turn "off".

The rate of change of the output signals from the Tri-stable is set by the control. If the control is set to "1", the outputs will change slowly, and can be used for slow wipes and fades. If the control is set to "10", the change will occur rapidly between video frames. The outputs are complementary, which means that as one output is changing from zero to full scale, another output is changing from full scale to zero.

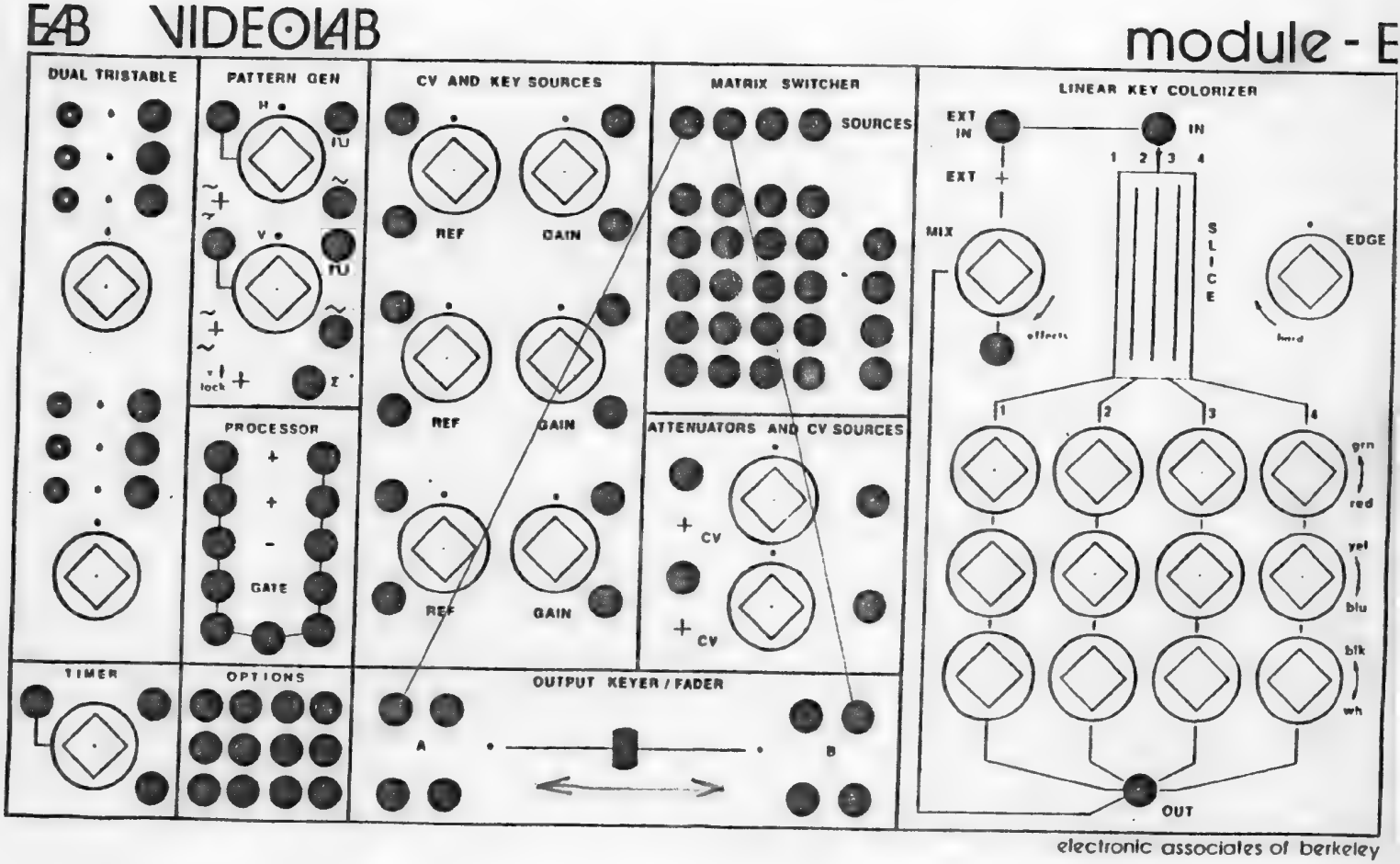
TIMER

The Timer is a source of full scale complementary control signals and is used to produce automatically alternating effects. The outputs of the timer, which are the two yellow jacks, will switch between zero and full scale continuously as slowly as several seconds, or as rapidly as every video frame. The rate is determined by the setting of the control. The timer is also a source of manually adjustable control voltage, appearing at the yellow jack left of the control. The timer rate may also be set externally by applying a control signal to this jack when the control is set counter-clockwise.

E MODULE EFFECTS DIAGRAM BY: WH DATE: NO. (1)

TITLE: MANUAL DISSOLVE TWO IMAGES

SCENE:



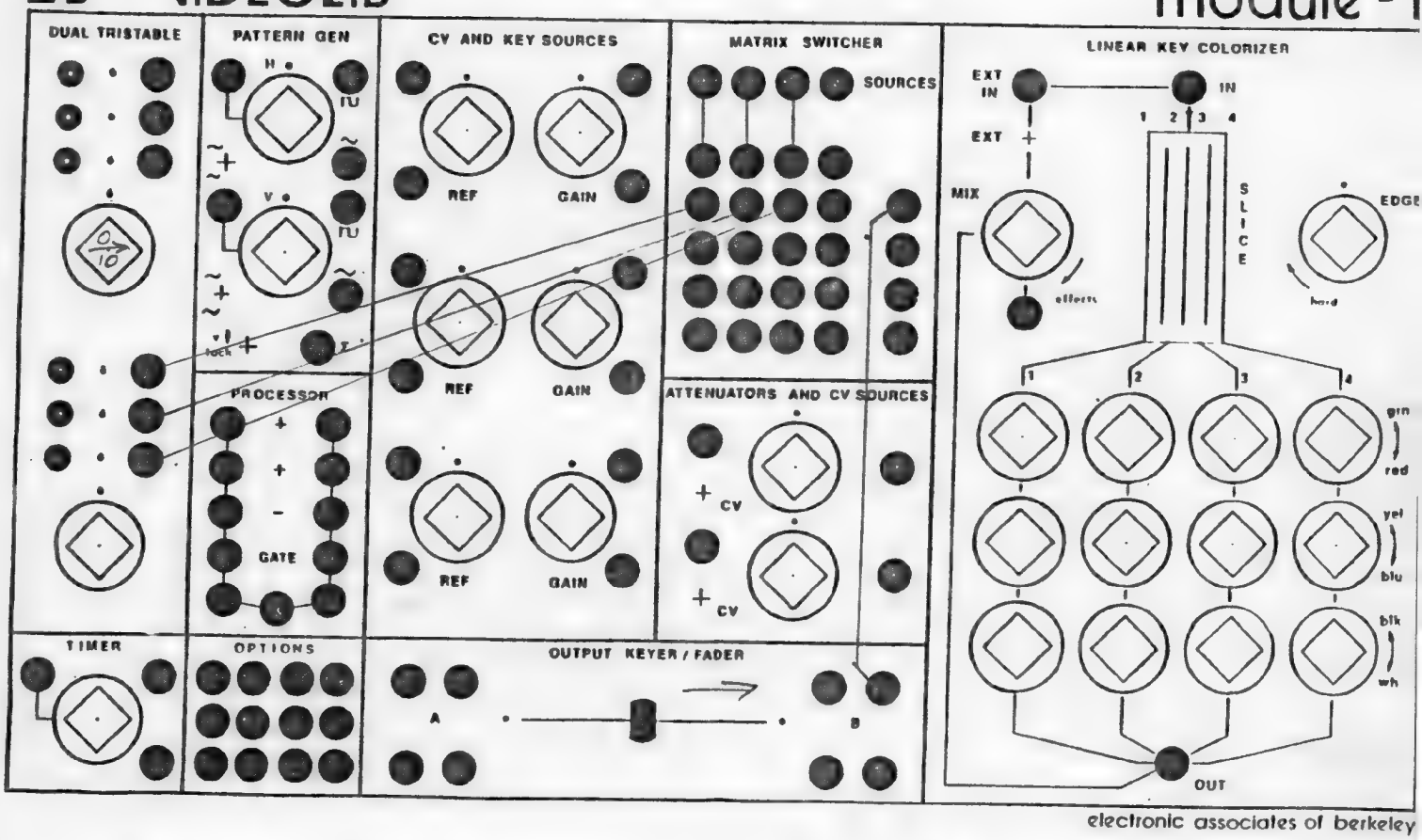
DESCRIPTION:

Move fader from left do right.

E MODULE EFFECTS DIAGRAM BY: WH DATE: NO. (2)

TITLE: SWITCH / DISSOLVE CHANNELS 1, 2, 3.

SCENE:

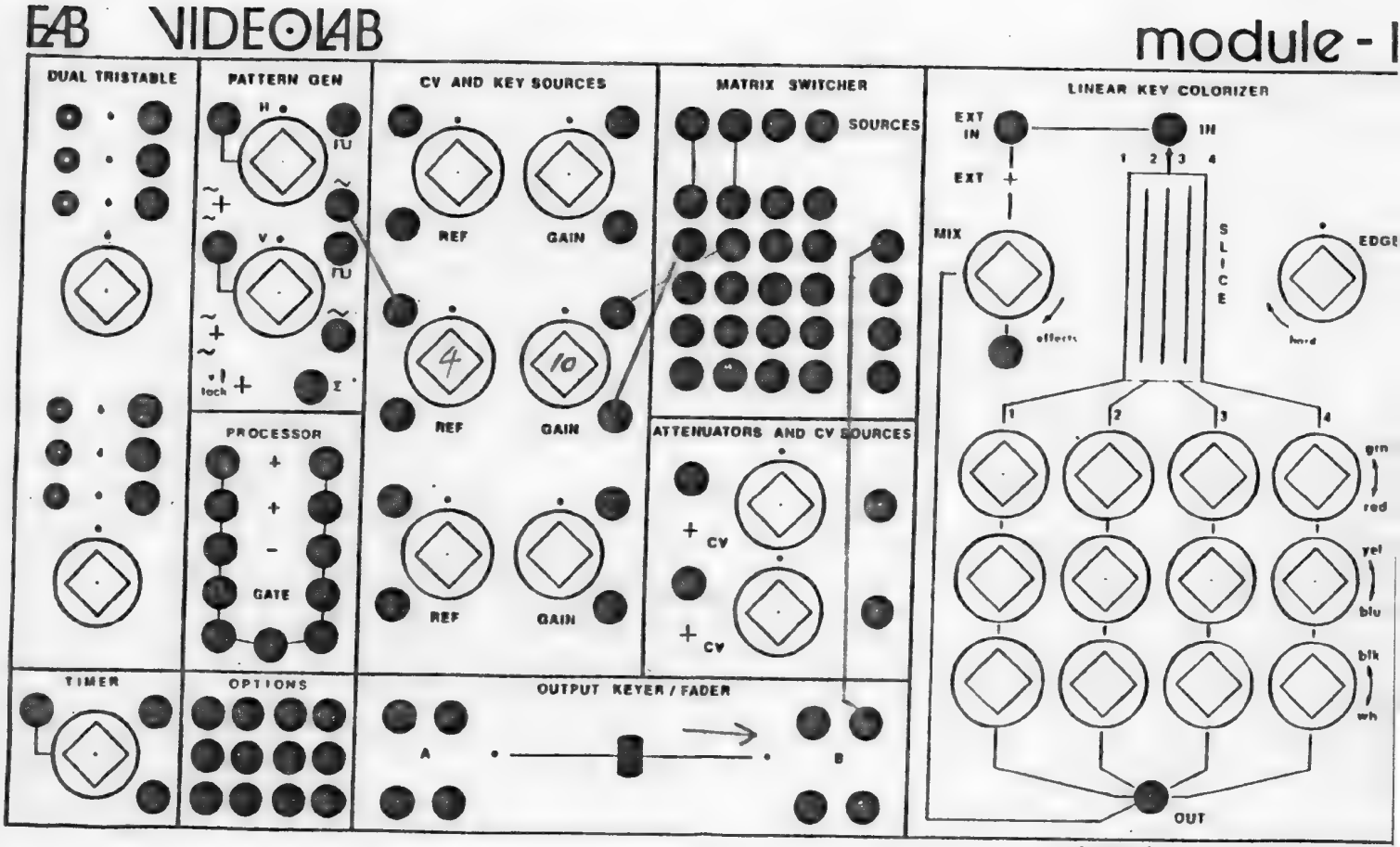


DESCRIPTION: Press P_1, P_2, P_3 for dissolve. Advance C_1 for increasing speed. IFC1 set to 10, Vertical interval switch must occur.

E MODULE EFFECTS DIAGRAM BY: wlt DATE: NO. (3)

TITLE: Split Screen, CHANNEL 1 (LEFT) CHANNEL 2 (RIGHT)

SCENE: (HORIZONTAL)

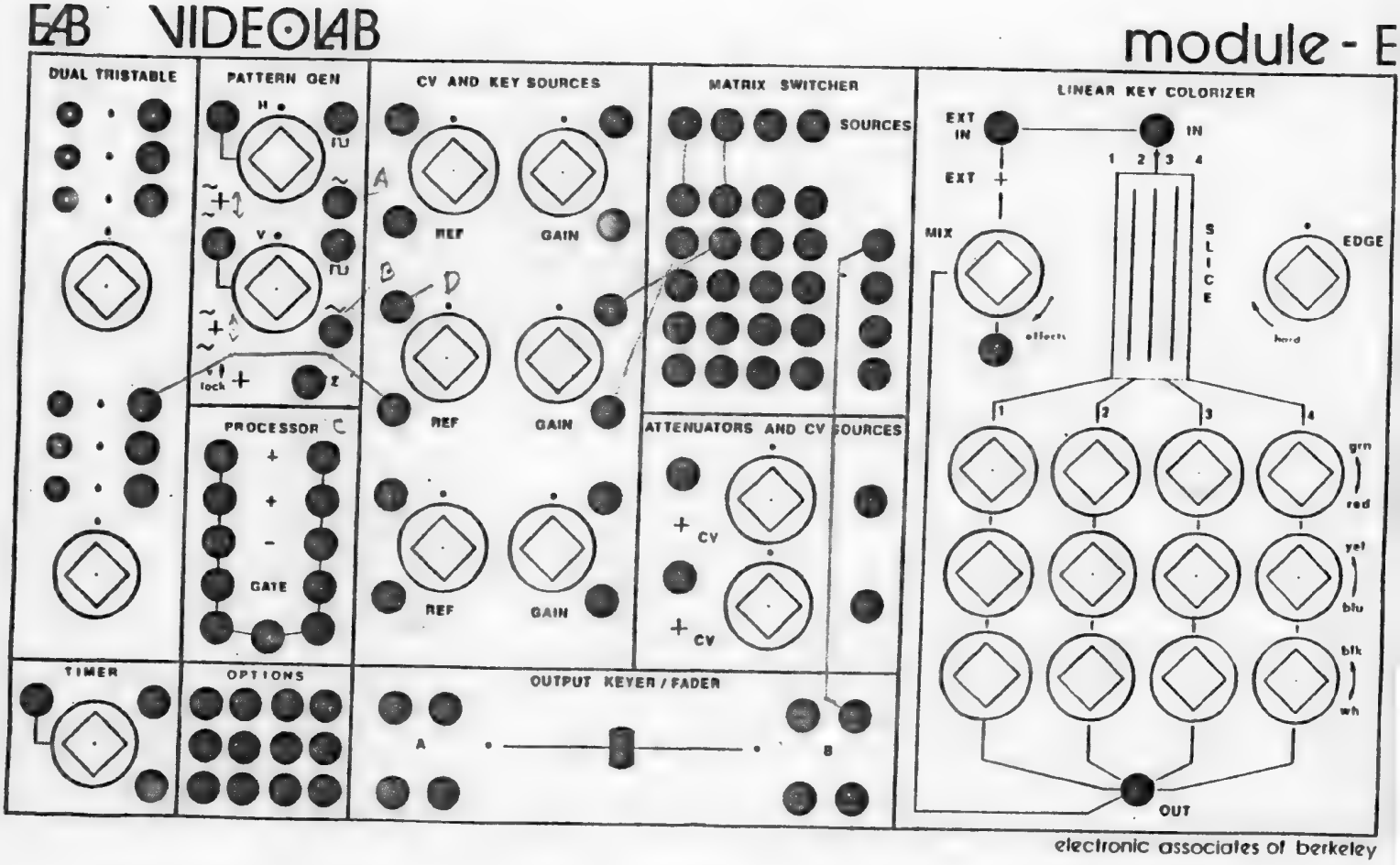


DESCRIPTION: Position with "Ref" knob

E MODULE EFFECTS DIAGRAM BY: MH DATE: NO. 4

TITLE: WIPE CHAN 1, 2, (AUTOMATIC)

SCENE:



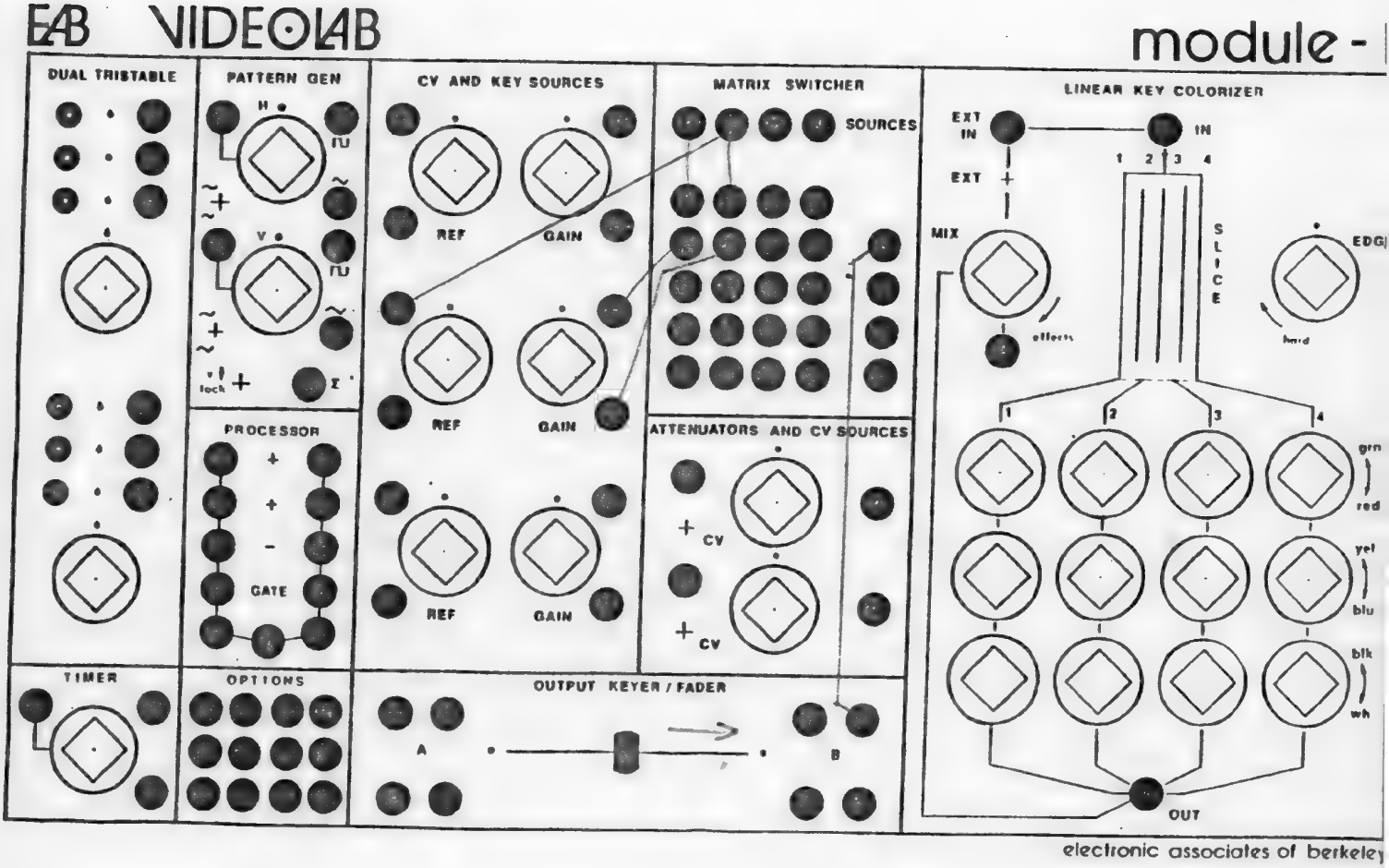
P1
P2

DESCRIPTION: Attach point "D" to "A", "B", or "C" for a variety of wipe types.

E MODULE EFFECTS DIAGRAM BY: WH DATE: NO. 5

TITLE: LUMINANCE KEY : CHANNEL 1 INTO HIGHLIGHTS OF CHANNEL 2

SCENE:



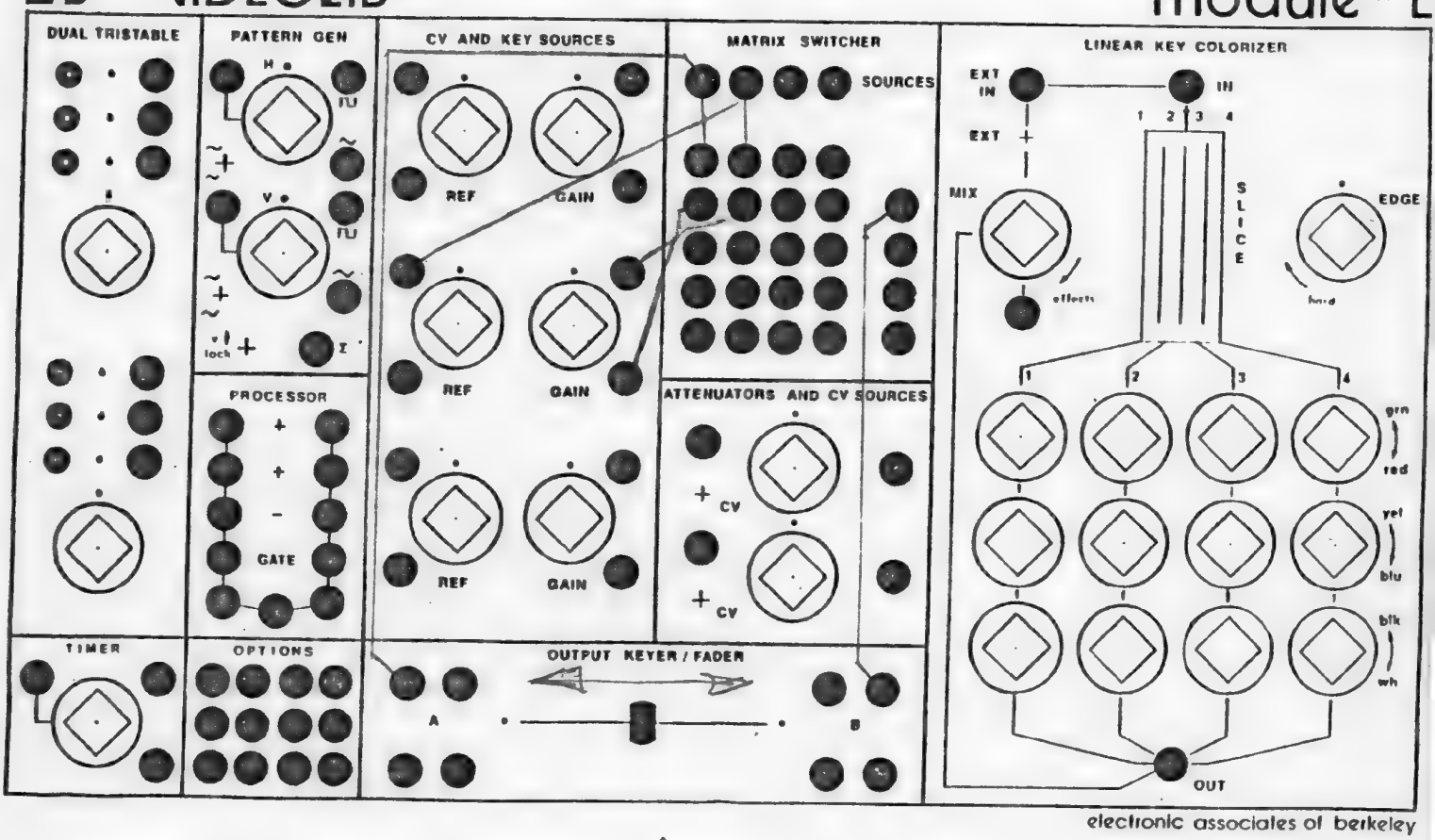
DESCRIPTION:

ADJust level with "Ref" control.

E MODULE EFFECTS DIAGRAM BY: DATE: NO. 6

TITLE: WHITE TITLES KEYED OVER

SCENE: CHANNEL 1 - IMAGE CHANNEL 2 - WHITE TITLES.

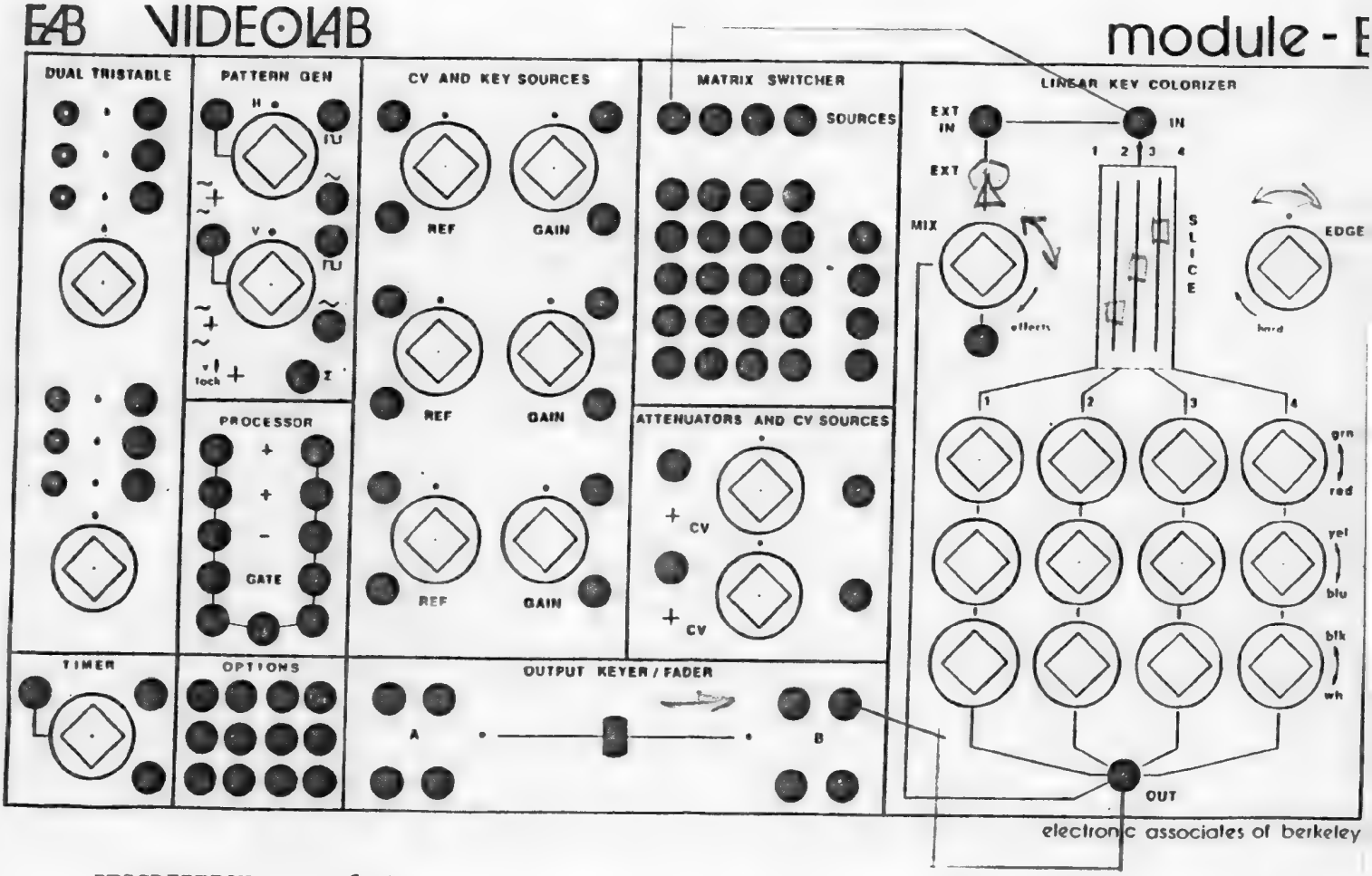


DESCRIPTION: Fader left for normal image, Right brings up titles. Titles are white letters on black board.

E MODULE EFFECTS DIAGRAM BY: WH DATE: NO. 7

TITLE: "COLORIZED" IMAGE (Chan. #1)

SCENE:

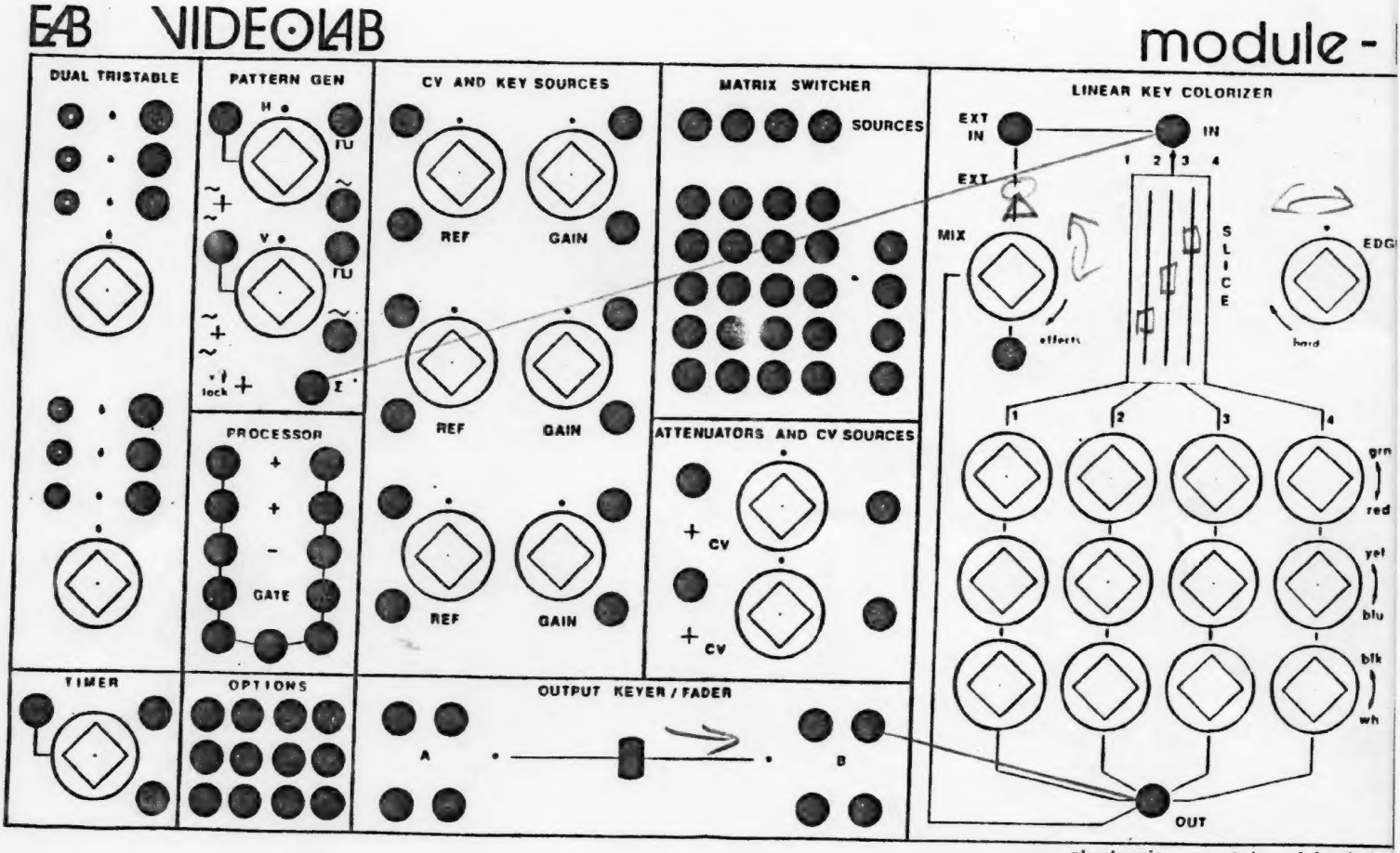


DESCRIPTION: CHANNEL 1 IN MAY be either monochrome or color. Rotate "MIX" knob to mix straight image with colorized image.

E MODULE EFFECTS DIAGRAM BY: WH DATE: NO. 8

TITLE: Colorized Patterns.

SCENE:



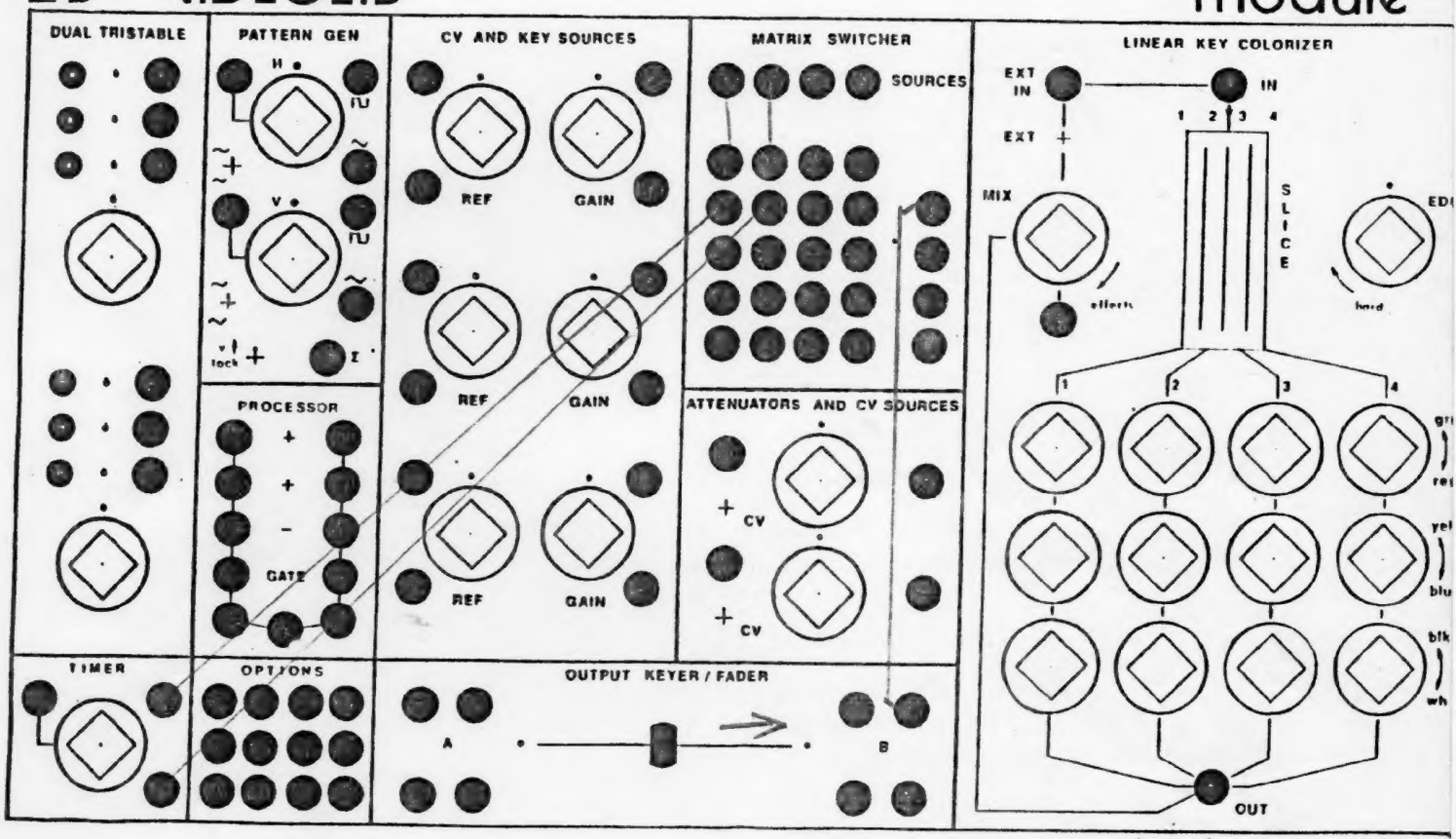
DESCRIPTION: Simple abstract patterns of first order formed by Colorizing output of pattern generator

VIDEOLAB

E MODULE EFFECTS DIAGRAM BY: WH DATE: NO. 9

TITLE: AUTOMATIC ALTERNATION OF TWO IMAGES (VERTICAL INTERVAL).

SCENE: Chan 1 & 2

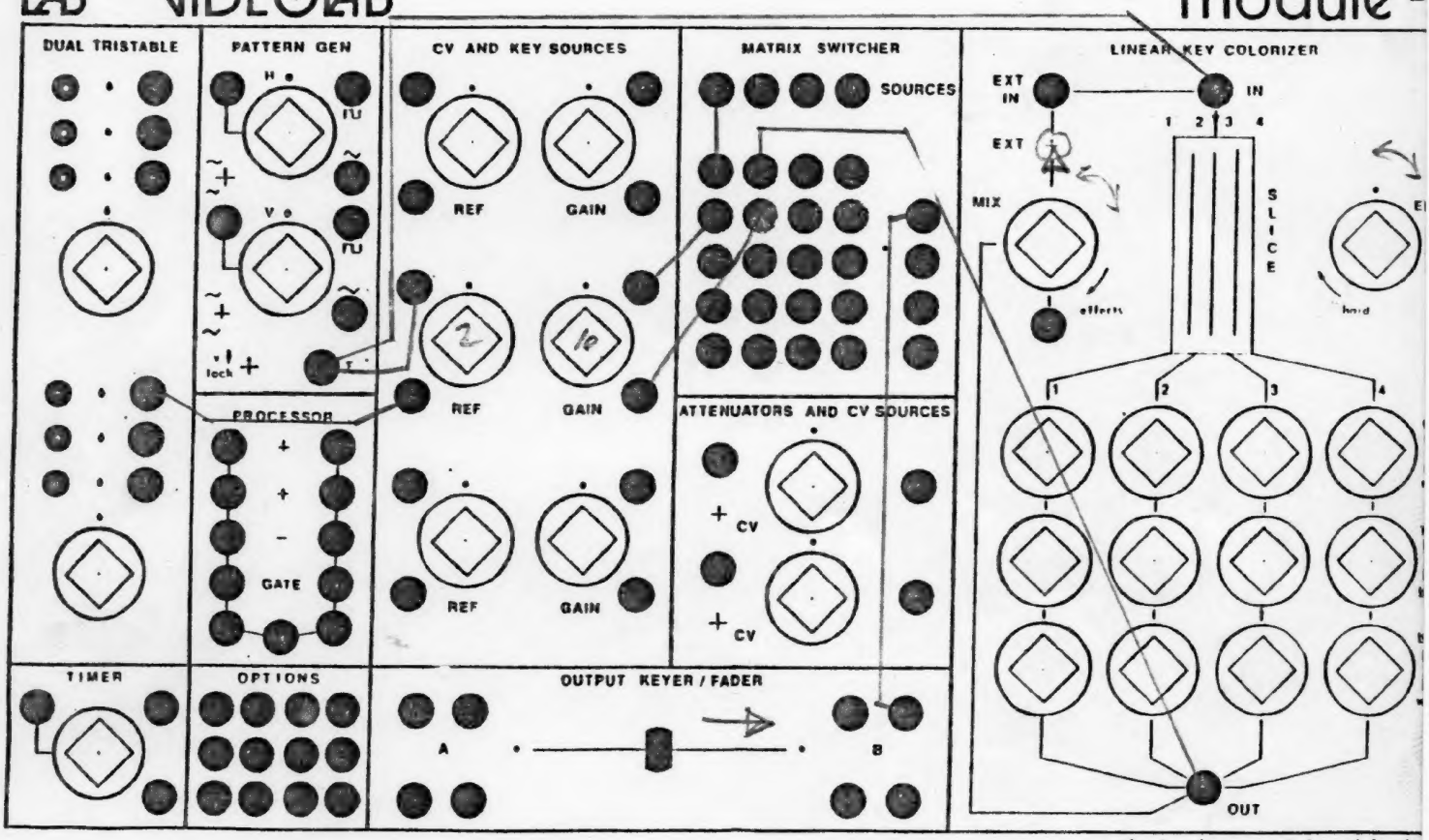


DESCRIPTION: SET timer rate for speed of alternation

E MODULE EFFECTS DIAGRAM BY: WH DATE: NO. 10

TITLE: WIPE FROM IMAGE TO COLORIZED PATTERN

SCENE: ON PATTERN STAGE



P1
P2

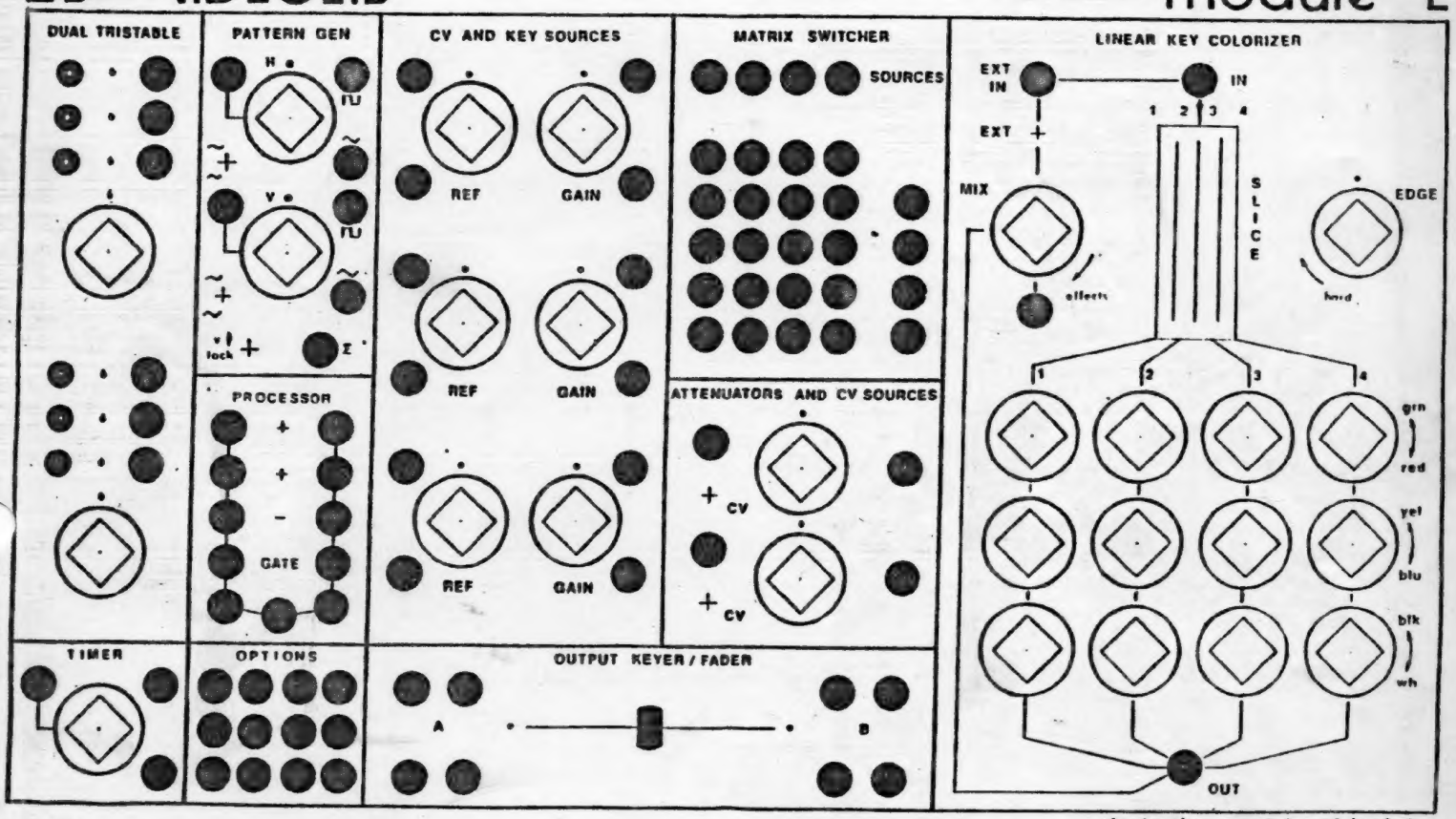
DESCRIPTION: Press P1 & P2 for wipe.

E MODULE EFFECTS DIAGRAM BY: DATE: NO.

TITLE:

SCENE:

EAB VIDEOLAB module - E



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DESCRIPTION: